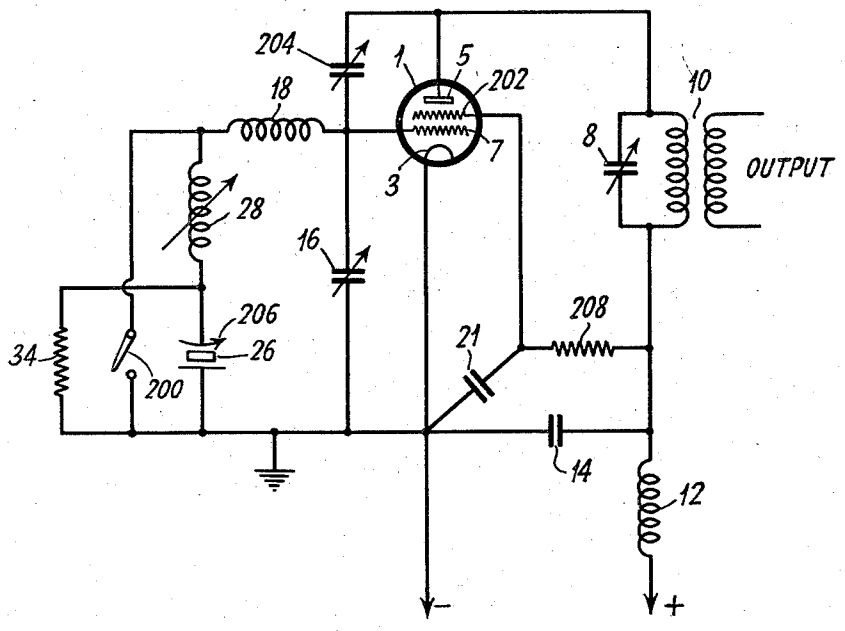
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OSCILLATION GENERATOR

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OSCILLATION GENERATOR

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3 Claims. (Cl. 250—36)

This invention relates to constant frequency crystal controlled oscillation generators. The instant application is a division of my co-pending application, Serial No. 132,040, which was filed March 20, 1937, now Patent No. 2,137,687 dated November 22, 1938.

Crystal controlled oscillation generators are generally employed to control transmitters so that the emitted waves correspond in frequency to the frequencies allotted to them. Unfortunately, transmitter operators frequently cannot resist the temptation to adjust or otherwise alter the tuning and other adjustments of crystal controlled generators, thereby unwittingly causing transmission at undesired wave lengths. One object of my present invention is, accordingly, to provide an oscillation generator which is substantially fool-proof and which, even though tuning adjustments are altered, continues to operate at the desired operating frequency or, rather than operate at some unassigned frequency, ceases to operate entirely.

In effecting this object, I provide a generator which will oscillate efficiently at the correct frequency with the frequency controlling circuit, such as a crystal, short circuited. Arrangements are made so that when the short circuit is removed, the frequency controlling circuit or the crystal is inserted effectively in series with an oscillating circuit of the generator. If the generator adjustments or settings are changed in any way so as to cause a frequency departure away from the natural frequency of the frequency controlling circuit, the frequency controlling circuit, rather than act as a short circuit, serves to inject high reactance in the generator system causing a return to the desired frequency or such losses as to cause cessation of operation, as will be explained more fully hereinafter.

My invention will now be described in more detail, reference being made to the accompanying drawing, the sole figure of which shows a circuit diagram of a preferred embodiment.

Referring to the drawing, I show an electron discharge tube 1 which is provided with a cathode 3, an anode 5, a control grid 7 and a screen grid 202. The anode-to-cathode circuit is tuned by means of an adjustable capacitor 8 in shunt with the inductance of a primary winding 10 of an output transformer. This circuit is fed with direct current from any suitable source (not shown). Such a source may be by-passed for alternating currents by means of a capacitor 14. The screen grid 202 may be maintained at suitable operating voltage through the action of a voltage dropping resistor 208. A by-pass capacitor is connected between the screen grid 202 and ground.

The input circuit includes a tuning condenser 16 and inductances 18 and 28, the latter being preferably made adjustable.

A feed-back condenser 204 is connected between the anode 5 and the grid 7 to supplement the anode-to-grid capacity if necessary.

The grid coil system 18, 28 is connected through a resistor 34 to ground. In shunt with this resistor is a frequency controlling unit in the form of a piezo-electric device 26. A switch 200 is provided for at times short-circuiting the elements 28, 34 and 26.

If the circuits change in frequency as, for example, should the condensers 8 and/or 16 be turned, the crystal will present a high reactance of a kind which tends to reduce the change in oscillation frequency. At the same time, the reactance will cause currents to flow through the shunting resistor 34. As a result, losses will arise which also will tend to cause the oscillation generator to return to a frequency giving minimum loss, namely, it will cause the generating system to tend to return to the desired frequency which causes the crystal to act as an effective short circuit. If the change produced in the circuits of the oscillation generating system is too great with accompanying larger losses, the entire system will cease oscillating. Hence, it follows that an operator or any other person cannot put the frequency substantially off the normal operating frequency by incorrect adjustment.

A further advantage of the oscillation generator shown resides in the fact that it will produce a high power output at substantially constant frequency.

When putting this oscillator in operation, switch 200 is first closed, short circuiting the crystal 26 and its series connected electrode capacity tuning coil 28. The grid tuned circuit consisting of variable condenser 16 and coil 18, and the plate circuit consisting of condenser 8 and coil 10 are then tuned so that oscillation generation takes place at a desired operating frequency. The feedback may be adjusted by simply tuning the grid and plate circuits or, if desired, in the alternative or in addition, the screen grid 202 may be caused to substantially eliminate inter-electrode feedback and the external variable feed-back condenser 204 may be utilized for additional regenerative control.

In any event, with the system oscillating, the crystal 26 and coil 28 short circuited by the action

of switch 200, the switch 200 is then opened. The frequency should then be brought back to the desired operating frequency corresponding to the frequency of the frequency controlling circuit or crystal 26 by adjusting the coil 28 serving to tune out the electrode to crystal capacity of the crystal holder for crystal 26. This may be facilitated by the provision of one or more adjustable crystal electrodes, such as crystal electrode 206.

When this last adjustment is made, the crystal system consisting of coil 28, the crystal 26 and its holder acts as an effective short circuit. In other words, it acts as effectively as when the switch 200 is in its closed position. Should the system now be tuned away from the crystal frequency, the crystal will offer a high reactance to the new frequency, causing losses in resistance 34 to such an extent that the system will stop oscillating. On the other hand, if the change in tuning is not great, the oscillator will tend to operate at minimum loss at that frequency for which the crystal is an effective short circuit, that is, at the desired operating frequency rather than at some different frequency.

Obviously, many changes may be made within the scope of my present invention. For example, inductive feed-back may be used, in which case coils 10 and 18, or 10 and 20 may be coupled together. Also, for example, the present invention may be incorporated in an electron coupled type of generator in which the present plates or anodes would be replaced by grids of a tube and the output taken from the normal plates of the tubes in the manner shown, for example, in Harry Tunick Patent No. 2,044,137, granted June 16, 1936.

I claim:

1. An oscillation generator comprising an electron discharge tube having an anode, a cathode, a control grid and a screen grid, a circuit having an inductive winding and a capacitor connected between the anode and cathode, means for applying a potential to said screen grid with respect to said cathode feed-back producing means including a variable capacitor connected between the anode and control grid for supplementing the inherent capacitance between these electrodes, a tuned circuit having inductance in parallel with a variable capacitor connected between said control grid and said cathode, a piezo-electric crystal device having negligible impedance at the desired operating frequency connected in series with said inductance in the inductive branch of said grid-to-cathode tuned circuit, means including a portion of said inductance for tuning out the crystal electrode capacity, a resistance circuit connected in shunt with said piezo-electric device, and means operable when starting up said generator for short-circuiting said piezo-electric device, said resistor and at least a portion of said inductance.

2. An oscillation generator comprising an electron discharge tube having a cathode, an anode and a plurality of grids including a control grid and a screen grid, a parallel resonant circuit interconnecting the anode and the cathode, means for maintaining an operating potential on said screen grid with respect to the cathode, a second parallel resonant circuit interconnecting the control grid and the cathode, a feed-back arrangement comprising a capacitor intercoupling the anode and control grid, a piezo-electric device connected in the inductive branch of said second parallel tuned circuit, a portion of said inductive branch constituting means for neutralizing the inherent capacitance of said piezo-electric device, a resistor shunting said piezo-electric device, and switching means for at times short-circuiting said piezo-electric device together with said resistor and the neutralizing portion of said inductance.

3. Apparatus for generating oscillations of a predetermined frequency comprising an electron discharge tube having a cathode, an anode and a grid, an input circuit connected between the cathode and grid and including series-connected inductive and resistive elements in parallel with a capacitor, said input circuit resonating at said predetermined frequency, an output circuit connected between the anode and cathode, means for resonating said output circuit at substantially said predetermined frequency, a piezo-electric device in said input circuit in shunt with said resistor and constituting an effectual short circuit thereto at said predetermined frequency, and further constituting a sufficiently high impedance to disable said oscillator when the latter is tuned away from said predetermined frequency, means for capacitively intercoupling the anode and grid in such manner that an optimum quantum of feed-back energy is obtained, and means operative when starting up said oscillator for shorting out said resistor, said piezo-electric device and a portion of said inductive elements.

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